DEPARTMENT OF STATISTICS

UNIVERSITY OF JAMMU

(NAAC Accredited "A+" Grade University)

Baba Saheb Ambedkar Road, Jammu-18006

No. PGD/STAT/22/ 257   **Dated :28-08-2022**

To
The Deputy Registrar (Academics)
University of Jammu,
Jammu

Subject: Minutes of meeting of BoS in Statistics

Madam,

In reference to university letter no. F.Acd./II/22/1839-98 dated 07-07-2022 on the subjected cited above kindly find the minutes of BoS held on 12/08/2022 along with framed syllabus of Semesters 1 to III of FYUP in the subject of Statistics for kind approval from the competent authority.
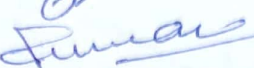
Thanking you.

Prof. Parmil Kumar
Head

DEPARTMENT OF STATISTICS
UNIVERSITY OF JAMMU

MINUTES OF THE MEETING OF BOARD OF STUDIES IN STATISTICS HELD ON
12/08/2022

Meeting of the Board of Studies in Statistics was held on 12/08/2022 at 11.30 A.M. in the office of the Head, Department of Statistics, University of Jammu.

The following were present:
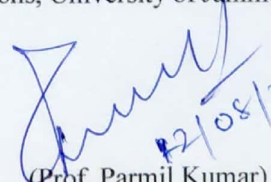
1.	Prof. Parmil Kumar	Convener
2.	Prof. Rahul Gupta	Member
3.	Prof. Pawan Kumar	Member
4.	Mr Kishore Kumar (ISS)	Member (Industrial Representative)
5.	Prof. Mohinder Pal (Special Invitee)	HoD, Dept. of Statistics, PSPSGCW
6.	Dr. V K Shivgotra	Member
7.	Dr. Sunil Kumar	Member
8.	Dr. Sandeep Kumar	Member, HoD, Dept. of Statistics, GDC,Ramgarh
9.	Dr. Ankush Bharti	Member, HoD, Dept. of Statistics, GDC,Udhampur
10.	Dr. Devya Mahajan (Special Invitee)	Dept. of Statistics, GDC,Kathua
11.	Dr. Rashpal Singh (Special Invitee)	Dept. of Statistics, GCW,Parade,Jammu
12.	Dr. Ameena Rajput (Special Invitee)	Dept. of Statistics, GCW,Parade,Jammu
13.	Dr. Ankita Sharma (Special Invitee)	Dept. of Statistics, MAM College,Jammu

The following items were discussed in the meeting:

1. **To confirm the minutes of the BOS meeting held on** 12-08-2022, **already circulated.**

   RESOLVED that the minutes of the meeting of BOS held on 12-08-2022 be confirmed.

2. **Formation of Syllabi and Courses of study in the subject of Statistics under National Education Policy at UG Level for Semester I and II for the Academic Sessions 2022-23, 2023 -24 and 2024-25.**

   RESOLVED that the courses of study and syllabi for the Academic Sessions 2022-23, 2023 -24 and 2024-25 of Semesters I and II have been framed at UG level as per the National Education Policy. Further **RESOLVED** that Syllabi and Courses of study in the subject of Statistics under National Education Policy at UG level for **Semester IV to VIII** shall be framed in the next meeting of BOS to be held during **March-April, 2023**. The other guidelines & statutes shall be as per the University norms of the UG Level.

3. **To prepare the panel of the Paper Setter / Examiners to be sent to the Controller of Examinations, University of Jammu, Jammu.**

   It was **UNANIMOUSLY RESOLVED** that Convener BOS be authorized to frame the panel of Paper Setters and Examiners and the same may be sent to Controller of Examinations, University of Jammu, Jammu as and when required.

   The meeting terminated with vote of thanks.

(Prof. Parmil Kumar)
Convener

University of Jammu , Jammu
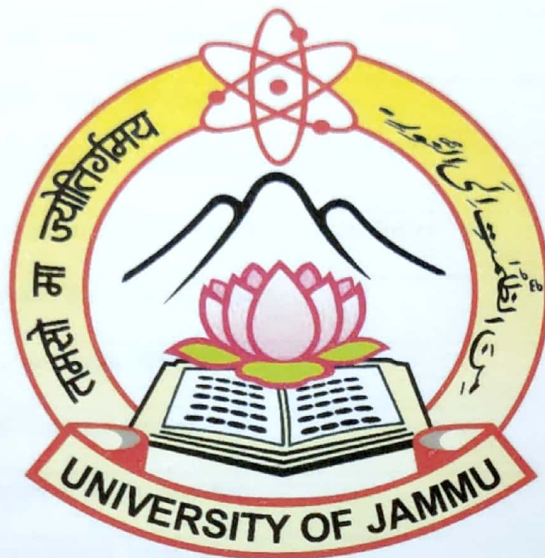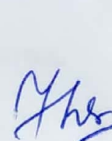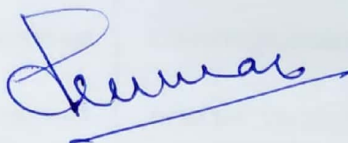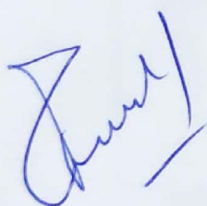
Syllabus of the Subject: Statistics
For Sem. I-III of Four Years Under-Graduate Programme (FYUP)

Aug. 2022

Members of the Board of Studies (Statistics) :

S.No.	Name
1.	Prof. Parmil Kumar, Convener
2.	Prof. Rahul Gupta, Member
3.	Prof. Pawan Kumar, Member
4.	Mr. Kishore Kumar, ISS, Member from Industry
5.	Dr. Mohinder Pal, Special Invitee
6.	Dr. V.K. Shivgotra, Member
7.	Dr. Sunil Kumar, Member
8.	Dr. Sandeep Sharma, Member
9.	Dr. Ankush Bharti, Member
10.	Dr. Rashpal Singh, Special Invitee
11.	Dr. Ameena Rajput, Special Invitee
12.	Dr. Devya Mahajan, Special Invitee
13.	Dr. Ankita Sharma, Special Invitee

FYUP SEMESTER-WISE TIMELINE/ SCHEME

SEMESTER	COURSES	COURSE CODE	TITLE	CREDITS Theory + Practical
I	MAJOR	UMJSTT101	DESCRIPTIVE STATISTICS	3+1
	MINOR	UMISTT102	DESCRIPTIVE STATISTICS	3+1
	SEC	USESTT103	COMPUTATIONAL STATISTICS USING EXCEL	0+2
	MDC	UMDSTT104	STATISTICS FOR RESEARCHERS	3+0
II	MAJOR	UMJSTT201	PROBABILITY THEORY	3+1
	MINOR	UMISTT202	PROBABILITY THEORY	3+1
	SEC	USESTT203	DATA ANALYSIS USING R	0+2
	MDC	UMDSTT204	STATISTICAL TECHNIQUES FOR RESEARCHERS	3+0
III	MAJOR	UMJSTT301	PROBABILITY DISTRIBUTIONS	3+1
		UMJSTT302	STATISTICAL INFERENCE	3+1
	MINOR	UMISTT303	PROBABILITY DISTRIBUTIONS	3+1
	SEC	USESTT304	ADVANCE ANALYTICS IN R FOR DATA SCIENCE	0+2
	MDC	UMDSTT305	ADVANCED STATISTICS FOR RESEARCHERS	3+0
IV	MAJOR	UMJSTT401	THEORY OF SAMPLE SURVEYS	3+1
		UMJSTT402	DEMOGRAPHY AND VITAL STATISTICS	3+1
		UMJSTT403	SAMPLING DISTRIBUTIONS	3+1
		UMJSTT404	OPERATIONS RESEARCH	3+1
	MINOR	UMISTT405	STATISTICAL INFERENCE	4+0
	SEC	-----------------	------------------	-----
	MDC	-----------------	------------------	----
V	MAJOR	UMJSTT501	DESIGN OF EXPERIMENTS	3+1
		UMJSTT502	STATISTICAL QUALITY CONTROL	2+0
		UMJSTT503	OFFICIAL STATISTICS	1+0
	MINOR	UMISTT504	DESIGN OF EXPERIMENTS	3+1
	SEC	USESTT505	PYTHON FOR DATA SCIENCE (Summer Internship)	0+2

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VI		MAJOR	UMJSTT601	APPLIED STATISTICS	3+1
			UMJSTT602	STATISTICAL COMPUTING USING C++PROGRAMMING	3+1
			UMJSTT603	SURVIVAL ANALYSIS AND BIOSTATISTICS	4+0
			UMJSTT604	STATISTICS FOR ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING	3+1
		MINOR	UMISTT605	APPLIED STATISTICS	4+0
		SEC	--------------	--------	-------
VII		MAJOR	UMJSTT701	STOCHASTIC PROCESSES AND QUEUING THEORY	4+0
			UMJSTT702	MULTIVARIATE ANALYSIS	4+2
			UMJSTT703	ADVANCED RESEARCH METHODS AND TECHNIQUES	4+2
		MINOR	UMISTT704	STOCHASTIC PROCESSES AND QUEUING THEORY	4+0
		SEC	-----------------	------------	---------
VII	4 YRS UG Honors with Research	MAJOR	UMJSTT801	LINEAR MODELS	3+1
		MINOR	UMISTT802	LINEAR MODELS	3+1
		SEC	USESTP803	RESEARCH PROJECT/ DESSERTATION	0+12
	4 YRS UG Honors	MAJOR	UMJSTT804	LINEAR MODELS	4+2
			UMJSTT805	STATISTICAL INFERENCE -II	4+0
			UMJSTT806	ECONOMETRICS	4+0
			UMJSTT807	ADVANCE PYTHON FOR DATA HANDLING	0+2
		MINOR	UMISTT808	ADVANCED STATISTICAL INFERENCE	4+0
		SEC	USESTT809	DATA HANDLING USING SOFTWARE	0+2

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Abbreviations Used:
SEC: Skill Enhancement Course
MDC: Multidisciplinary Course

:: Subject Prerequisites::

To study this subject as Major/Minor a student must have studied the subject(s) of Mathematics/Statistics at the level of class 12th
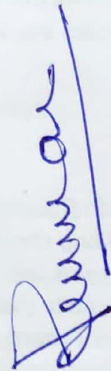
:: Programme Outcomes (POs) ::

Students having Under-graduate Degree (with Statistics) should have knowledge of different concepts and fundamentals of Statistics and ability to apply this knowledge in various fields of industry. They may pursue their future career in the field of Statistics and Research.

:: Programme Specific Outcomes (PSOs)::

After completing Under-graduate Degree (with Statistics) the student should have

➤ Knowledge of different concepts, principles, methodologies and tools (skills) of Statistics.
➤ Ability to collect, tabulate, represent graphically, analyze and interpret data/information by using appropriatestatistical tools.
➤ Ability to identify and solve a wide range of problems in real life/industry related to Statistics.
➤ Familiarity with computational techniques and statistical software including programming language (e.g. R) formathematical and statistical computation.
➤ Capability to use appropriate statistical skills in interdisciplinary areas such as finance, health, agriculture, government, business, industry, telecommunication and bio-statistics.
➤ Ability to compete with industrial/private sector demand in the field of data analysis, marketing survey, etc. inprofessional manner and pursue their future career in the field of Statistics.
➤ Ability to develop original thinking for formulating new problems and providing their solutions. As a result, they willbe able to pursue higher studies or research in the field of Statistics.

SUBJECT: STATISTICS
Semester-First
Major /Minor Courses

Course Title: Descriptive Statistics
Course Code: UMJSTT101   (Major) / UMISTT 102 (Minor)

Max. Marks: 100   Credits:(3+1)

Syllabus for the Academic Session 2022-23,2023-24 and 2024-25

Subject Prerequisites:
To study this subject a student must have knowledge of basic concepts of Mathematics.

Course Outcomes:
After completing this course, a student will have
- Knowledge of Statistics, its scope and importance in various fields & Ability to understand concepts of sample vs. population, different types of data.
- Diagrammatic & Graphical techniques used to represent data & ability to describe data with measures of central tendency and measures of dispersion & measures of Skewness and Kurtosis and their significance.
- Ability to deal with problems based on determination of Regression lines and calculation of Correlation coefficient – grouped and ungrouped data.
- Ability to deal with the problems based on determination of Rank correlation.

UNIT I
Introduction to Statistics- Statistics, Importance & Scope, Introduction and contribution of Indian Scholars in Statistics. Concept of Statistical population & Sample, Types of data-Discrete and Continuous, Different types of scales – Nominal, Ordinal, Ratio and Interval, Primary data – designing a questionnaire and schedule, Collection of primary data, checking their consistency, Secondary data. Presentation of data: Classification & Tabulation, Diagrammatic Representation –Line, Bar Diagram, Pie Diagram, Frequency distributions-basic Definitions with illustrations, Graphical Representation- Histogram, Frequency Polygon, Frequency Curve, O-give.

UNIT II
Measures of Central Tendency & Dispersion-Meaning, Requisites, Various types of measures of Central tendency & Dispersion along with properties and Merits & Demerits.

UNIT III
Partition Values, Moments-Meaning and their inter-relations with properties- problems on ungrouped and grouped data, Shephard's correction for moments (without Proof), Skewness & Kurtosis- Meaning, Measures of Skewness and Kurtosis and their significance, Measures based on quartiles.

UNIT IV
Bi-variate Data: Correlation, Types of relationships, Scatter diagram, Karl-Pearson's Correlation Coefficient and its properties, Spearman Rank correlation and its coefficient, Intra class correlation coefficient & correlation ratio. Coefficient of determination, Regression analysis through both types of regression equations for X and Y variables- Regression lines, regression coefficient and their properties.

Suggested Readings:

- David, S. (2003). Elementary Probability, 2nd Ed., Cambridge University Press.
- Dudewicz, E.J. and Mishra, S.N. (2008). Modern Mathematical Statistics, Wiley.
- Goon, A.M., Gupta, M.K. and Dasgupta, B. (1968). Fundamental of Statistics, Vol I, World Press, Kolkata.
- Goon, A.M., Gupta, M.K. and Dasgupta, B. (1968). Fundamental of Statistics, Vol II, World Press, Kolkata.
- Gupta, S.C. and Kapoor, V.K. (2020). Fundamentals of Mathematical Statistics, 12th Ed., Sultan Chand and Sons.
- Lipschitz, S., Lipson, M. L. and Jain, K. (2021). Schaum's Outline of Probability, McGraw Hill Education Pvt. Ltd, New Delhi.
- Johnson, S. and Kotz, S. (1972). Distribution in Statistics Vol. III, John Wiley & Sons, New York.
- Miller, I. and Miller, M. (2014). John E. Freund's Mathematical Statistics with Applications, 8th Ed., Pearson Education, Asia.
- Mood, A.M. Graybill, F.A. and Boes, D.C. (1974). Introduction to the Theory of Statistics, 3rd Ed., Tata McGraw-Hill Pub. Co. Ltd.
- Mukhopadhyay, P. (2006). Mathematical Statistics 3rd Ed., New Delhi, New Central Book Agency Pvt. Ltd.
- Rohatgi, V.K. and Saleh, A.E. (2008). An introduction to Probability Theory and Mathematical Statistics, Wiley Eastern.
- Weatherburn, C.E. (1961). A First Course in Mathematical Statistics, The English Lang. Book Society and Cambridge Univ. Press.
- Moore, D.S. (2009). The Basic Practice of Statistics. 5th Ed., W H Freeman.
- Neter, J (1987). Applied Statistics. 3rd Ed. Allyn and Bacon.
- Rowntree, D. (2018). Statistics Without Tears: An Introduction for Non-Mathematicians. Penguin Press
- Starnes, D.S (2022). The Practice of Statistics, 8th Ed., W H Freeman.
- Ummer, E.K. (2022). Basic Statistics for Economics, Business and Finance, Atlantic Publication.
- Walpole, R.E and Myers, R.H. (2013). Probability and Statistics for Engineers and Scientist. 9th Ed.,

Practicals based on Course.

- Problems based on graphical representation of data by Histogram, Frequency polygons, frequency curves and Ogives and to graphically locate measures of central tendency & Partition values
- Problems based on calculation of Measures of Central Tendency & partition values.
- Problems based on calculation of Measures of Dispersion.
- Problems based on calculation of Moments, Measures of Skewness and Kurtosis.
- Problems based on determination of Regression lines and calculation of Correlation coefficient – grouped and ungrouped data. Problems based on determination of Rank correlation and correlation ratio.
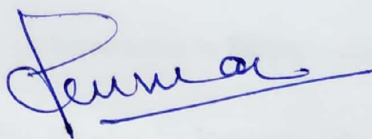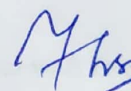
SCHEME OF EXAMINATIONS

THEORY	Syllabus to be covered in the examination	Time allotted	% Weightage (Marks)
Mid-term Assessment Test shall be conducted by the course coordinator. **Pattern**: One long answer type question of 10 marks and Five short answer type questions of marks each.	Up to 50%	$1\frac{1}{2}$ hours	15
External End Semester University Exam **Pattern**: As proposed by the concerned BOS and approved by Academic Council	Up to 100%	03 hours	60
Total			75
PRACTICAL			
Internal: Daily evaluation of practical records/Viva voce/attendance etc.	10 (including 20% for attendance, 20% for Viva-voce and 40% for internal test and 20% day to day performance)		
External: Final Practical Performance viva voce	100% Syllabus		15 = 10 Exam 05 viva-voce
Total			25

NOTE FOR PAPER SETTING: End Semester External University Examination

The question paper will contain **TWO** Sections.

Section-A will consist of **FOUR COMPULSORY** short answer type questions (to be answered in 70-80 words) i.e., one question from each unit. Each question shall carry **3 marks.**

Section -B will contain **EIGHT** long answer type questions (to be answered in 500-600 words), Two questions from each unit and the student has to attempt FOUR questions selecting one question from each unit. Each question shall carry 12 marks.

SUBJECT: STATISTICS
Semester–First
Skill Enhancement Course

Course Title: COMPUTATIONAL STATISTICS USING EXCEL (Practical)
Course Code: USESTT103

Max. Marks: 50   **Credits: 0+2**

Syllabus for the Academic Session 2022-23,2023-24 and 2024-25

Course Outcomes:
The objective of the course is to express the students to the real-life skill for statistical computing analysis and graphical interpretation using software skill. Hands on training on the following problem can be done on any one of the statistical software/excel to enhance data analysis skill.

UNIT-I
Introduction to Computers: Historical evolution of Computers. Generations of Computers. Classification of Computers, Applications of Computers, Computer Memory: Primary and Secondary Memory, Hardware: CPU, I/O Devices.
Word Processing: Creating and Saving a Document, Editing the Text: Printing, Saving and Importing Documents. Basics of Excel: Data Entry, Built in Functions in Excel.
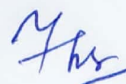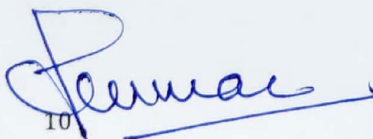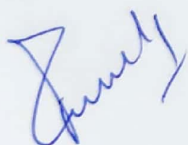
UNIT-II
Diagrammatic /Graphical Representation of data by Line diagram, Bar Diagram, Histograms, Frequency Polygon, Pie Chart, Ogive and Box Plot. Measures of Central Tendency, Partition Values.

UNIT-III
Measures of Dispersion, Skewness, Kurtosis, Bivariate Data: Scatter Diagram, Correlation, Covariance, Regression.
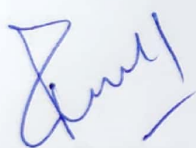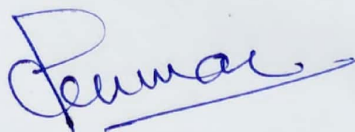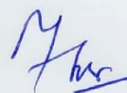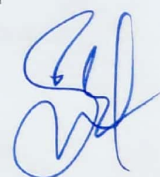
Books Recommended:
- Beverly, J. D. (1998). Statistics with Microsoft Excel 2008. Prentice Hall Press, US
- Brend Held (2007), Microsoft Excel Functions and Formulas. Wordware Publishing. Inc.
- D. Remenyi, G. Onofre. J. English (2011), An introduction Statistics Using Microsoft Excel. Academic Publishing Limited.
- Dan, R., George, O. and Joseph, E. (2011). An Introduction to Statistics using Microsoft Excel. 2nd ed., Academic Conferences Limited.
- David, S., David, S. and Kathryn, A. S. (2016). Statistics for Manager Using Microsoft Excel 8th Ed., Pearson.
- Gupta V., Bhatia S.S, Thakur P.S., Sharma V. (2018). Computer Fundamentals and IT Tools. Kalyani Publishers

- Gupta, S.C. and Kapoor, V.K. (2020). Fundamentals of Mathematical Statistics, 12th Ed., Sultan Chand and Sons.
- Rajaraman, V. (2014). Fundamentals of Computers, 6th Ed. PHI.
- Stephanie, G. (2014). Excel Statistics: Step by Step. CreateSpace Independent Pub.

SCHEME OF EXAMINATIONS

THEORY	Syllabus to be covered in the examination	Time allotted	% Weightage (Marks)
Internal Mid-Term Test **Pattern**: Three long answer type questions will be asked, student have to attempt any TWO questions. Each question shall carry 05 marks.	Up to 50%	1 hour	10
Internal End Term Test **Pattern**: Two long answer type questions will be asked; student will attempt one question of 05 marks and there shall be five Compulsory short answer type questions of 01 marks each.	Up to 100%	1 hour	10
Total			**20**
PRACTICAL			
Internal End Term: Practical Performance + viva voce Three practical problem-based questions one from each unit shall be asked, student will attempt any two of 10 marks each.	100% Syllabus 3 Hours		20 Exam 10 viva-voce
Total			**30**

SUBJECT: STATISTICS
Semester-First
Multidisciplinary Course

Course Title: STATISTICS FOR RESEARCHERS
Course Code: UMDSTT104

Max. Marks: 75   **Credits: (3+0)**

Course Outcomes:
After completing this Course, the student should have
- Knowledge of different concepts, principles, methodologies of Statistics.
- Ability to collect, tabulate, represent graphically, analyze and interpret data/information by using appropriate statistical tools.
- Ability to deal with problems based on Measures of central tendency, Dispersion, Skewness & Kurtosis.

Unit I
Introduction to Statistics- Statistics, Importance & Scope, Concept of Statistical population & Sample, Types of data-Discrete and Continuous, Primary data & Secondary Data, Presentation of data: Classification & Tabulation, Diagrammatic Representation –Line, Bar Diagram, Pie Diagram, Frequency distributions-basic Definitions with illustrations

Unit II
Graphical Representation- Histogram, Frequency Polygon, Frequency Curve, O-give.
Measures of Central Tendency -Meaning, Requisites, Various types of measures of Central tendency with properties and Merits & Demerits.

UNIT III
Partition values, Measures of Dispersion- Meaning, Requisites, Various types of measures of Central tendency with properties and Merits & Demerits

UNIT V
Skewness & Kurtosis- Meaning, Measures of Skewness and Kurtosis and their significance along with their properties.

Suggested Readings:
- Goon, A.M., Gupta, M.K. and Dasgupta, B. (1968). Fundamental of Statistics, Vol I, World Press, Kolkata.
- Goon, A.M., Gupta, M.K. and Dasgupta, B. (1968). Fundamental of Statistics, Vol II, World Press, Kolkata.
- Moore, D.S. (2009). The Basic Practice of Statistics. 5th Ed., W H Freeman.
- Neter, J (1987). Applied Statistics. 3rd Ed. Allyn and Bacon.

- Rowntree, D. (2018). Statistics Without Tears: An Introduction For Non-Mathematicians. Penguin Press
- Starnes, D.S (2022). The Practice of Statistics, 8th Ed., W H Freeman.
- Ummer, E.K. (2022). Basic Statistics for Economics, Business and Finance, Atlantic Publication.
- Walpole, R.E and Myers, R.H. (2013). Probability and Statistics for Engineers and Scientist. 9th Ed.,

SCHEME OF EXAMINATIONS

THEORY	Syllabus to be covered in the examination	Time allotted	% Weightage (Marks)
Mid-term Assessment Test shall be conducted by the course coordinator. **Pattern**: One long answer type question of 10 marks and Five short answer type questions of marks each.	Up to 50%	$1\frac{1}{2}$ hours	15
External End Semester University Exam Pattern: As proposed by the concerned BOS and approved by Academic Council	Up to 100%	3 hours	60
Total			**75**

NOTE FOR PAPER SETTING: End Semester External University Examination

The question paper will contain **TWO** Sections.

Section-A will consist of **FOUR COMPULSORY** short answer type questions (to be answered in 70-80 words) i.e., one question from each unit. Each question shall carry **3 marks.**

Section -B will contain **EIGHT** long answer type questions (to be answered in 500-600 words), Two questions from each unit and the student has to attempt FOUR questions selecting one question from each unit. Each question shall carry 12 marks.

SUBJECT: STATISTICS
Semester-Second
Major /Minor Courses

Course Title: PROBABILITY THEORY
Course Code: UMJSTT201 (Major) UMISTT202 (Minor)

Max. Marks: 100   **Credits: 3+1**

Syllabus for the Academic Session 2022-23,2023-24 and 2024-25

Course prerequisites: To study this course, a student must have opted/passed the Descriptive Statistics UMJSTT101/ UMISTT102

Course Outcomes:

After completing this course, a student will have:

- Ability to understand the concept of probability along with basic laws, mutually exclusive and independence and their relevance and ability to apply basic probability principles to solve real life problems
- Ability to understand the concept of random variable (discrete and continuous), concept of probability distribution & conditional probabilities based on Bayes Theorem.
- Ability to understand Probability Mass Function (pmf) and Probability density function (pdf), Cumulative distribution function (cdf), Marginal and Conditional distributions
- Ability to deal with problems of attributes.

UNIT I

Random experiment, Trial, Sample point and Sample space, Events, Operations of events, Concept of equally likely, mutually exclusive and Exhaustive events. Definition of Probability: Classical, Relative frequency and Axiomatic approaches. Discrete Probability Space, Properties of Probability under Set Theory Approach, Independence of Events, Conditional Probability, Total and Compound Probability theorems, Bayes theorem and its applications.

UNIT II

Random Variables – Discrete and Continuous, Probability Mass Function (pmf) and Probability density function (pdf), Cumulative distribution function (cdf) with properties, Joint distribution of two random variables, Jacobian Transformation for one and two variables with illustrations, Marginal and Conditional distributions, Independence of random variables.

UNIT III

Expectation of a random variable and its properties, Expectation of sum of random variables and product of independent random variables, Conditional expectation and related problems. Moment generating function (m.g.f.) & their properties. Cumulative generating function and characteristic function- Uniqueness and inversion theorems (without proof) along with applications. Conditional expectations
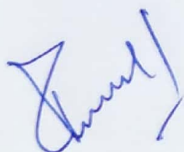
UNIT IV

Attributes: Notion and Terminology, Contingency table, Class frequencies and Ultimate class frequencies, Consistency, Association of Attributes, Independence, and Measures of association for 2X2 table, Coefficients of Association.

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Suggested Readings:

- Goon, A.M., Gupta, M.K. and Dasgupta, B. (1968). Fundamental of Statistics, Vol I, World Press, Kolkata.
- Goon, A.M., Gupta, M.K. and Dasgupta, B. (1968). Fundamental of Statistics, Vol II, World Press, Kolkata.
- Gupta, S.C. and Kapoor, V.K. (2020). Fundamentals of Mathematical Statistics, 12th Edn., Sultan Chand and Sons.
- Hogg, R.V. and Tanis, E.A. (2008). A Brief Course in Mathematical Statistics. Pearson Education.
- Lipschitz, S., Lipson, M. L. and Jain, K. (2021). Schaum's Outline of Probability 3rd Edn., McGraw Hill Education Pvt. Ltd, New Delhi.
- Johnson, R.A. and Bhattacharya, G.K. (2019). Statistics-Principles and Methods, 8th Edn. John Wiley and Sons.
- Johnson, S. and Kotz, S. (1972). Distribution in Statistics Vol. III, John Wiley & Sons, New York.
- Miller, I. and Miller, M. (2014). John, E. Freund's Mathematical Statistics with Applications, 8th Edn., Pearson Education, Asia.
- Mood, A.M. Graybill, F.A. and Boes, D.C. (1974). Introduction to the Theory of Statistics, 3rd Edn., Tata McGraw-Hill Pub. Co. Ltd.
- Mukhopadhyay, P. (2006). Mathematical Statistics 3rd Edn., New Delhi, New Central Book Agency Pvt. Ltd.
- Rohatgi, V.K. and Saleh, A.E. (2008). An introduction to Probability Theory and Mathematical Statistics, Wiley Eastern.
- Weatherburn, C.E. (1949). A First Course in Mathematical Statistics, The English Lang, 2nd Edn. Book Society and Cambridge Univ. Press.
- Moore, D.S. (2009). The Basic Practice of Statistics. 5th Ed., W H Freeman.
- Neter, J (1987). Applied Statistics. 3rd Ed. Allyn and Bacon.
- Rowntree, D. (2018). Statistics Without Tears: An Introduction For Non-Mathematicians. Penguin Press
- Starnes, D.S (2022). The Practice of Statistics, 8th Ed., W H Freeman.
- Ummer, E.K. (2022). Basic Statistics for Economics, Business and Finance, Atlantic Publication.
- Walpole, R.E and Myers, R.H. (2013). Probability and Statistics for Engineers and Scientist. 9th Ed.,

Practicals based on Course.

- Problem based on Probability
- Problems based on pmf, pdf & cdf
- Computation of conditional probabilities based on Bayes theorem.
- Computation of Joint, Marginal & Conditional probabilities.
- Checking consistency of data and finding association among attributes.
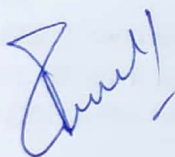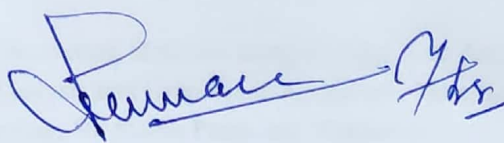
SCHEME OF EXAMINATIONS

THEORY	Syllabus to be covered in the examination	Time allotted	% Weightage (Marks)
Mid-term Assessment Test shall be conducted by the course coordinator. **Pattern**: One long answer type question of 10 marks and Five short answer type questions of marks each.	Up to 50%	$1\frac{1}{2}$ hours	15
External End Semester University Exam Pattern: As proposed by the concerned BOS and approved by Academic Council	Up to 100%	03 hours	60
Total			75
PRACTICAL			
Internal: Daily evaluation of practical records/Viva voce/attendance etc.	10 (including 20% for attendance, 20% for Viva-voce and 40% for internal test and 20% day to day performance)		
External: Final Practical Performance + viva voce	100% Syllabus		15 = 10 Exam 05 viva-voce
Total			25

NOTE FOR PAPER SETTING: End Semester External University Examination

The question paper will contain **TWO** Sections.

Section-A will consist of **FOUR COMPULSORY** short answer type questions (to be answered in 70-80 words) i.e., one question from each unit. Each question shall carry **3 marks.**

Section -B will contain **EIGHT** long answer type questions (to be answered in 500-600 words), Two questions from each unit and the student has to attempt FOUR questions selecting one question from each unit. Each question shall carry 12 marks.

SUBJECT: STATISTICS
Semester-Second
Skill Enhancement Course

Course Title: DATA ANALYSIS USING R (Practical)
Course Code: USESTT203

Max. Marks: 50   Credits: 0+2

Syllabus for the Academic Session 2022-23,2023-24 and 2024-25

Course Outcomes:

After completing this course, a student will have: Basic Knowledge of R programming with some basic notions for developing their own simple programs and visualizing graphics in R. Ability to perform data analysis for both univariate and multivariate data sets using R.

UNIT I

Introduction to R Programming and R Studio, Installing R, R as a calculator. Creating a data set, Understanding a data set, Data structure: Vectors, Matrices, Arrays, Data Frames, Factors and Lists

UNIT II

Data inputs: Entering data from the keyboard, Importing Data, creating new variables, recoding variable, renaming variables, plot a graph viz. histograms (equal class intervals and unequal class intervals), box plot, stem-leaf, frequency polygon, pie chart/3D pie chart, plot () function and line plot, ogives with graphical summaries of data

UNIT III

Random number generation and sampling procedures, Measures of Central Tendency, Measures of Dispersion, Skewness, Kurtosis, Correlation, Covariance, Regression, Test of Normality, Rank correlation, Measures of Association.

Suggested Readings:

- Crawley, M.J. (2013). The R Book, 2nd ed., John Wiley.
- Davies, T. M. (2016). The Book of R: A First Course in Programming and Statistics, No Starch Press, San Francisco.
- Field, A., Miles, J. and Field, Z. (2012). Discovering Statistics using R, Sage, Los Angeles.
- Kabacoff, R.I. (2015). R in Action: Data Analysis and Graphics in R, 2nd ed., Manning Publications.
- Matloff, N. (2011). The Art of R Programming, No Starch Press, Inc. Eckhouse,

SCHEME OF EXAMINATION

THEORY	Syllabus to be covered in the examination	Time allotted	% Weightage (Marks)
Internal Mid-Term Test **Pattern**: Two long answer type questions will be asked; student will attempt one question of 05 marks and there shall be five Compulsory short answer type questions of 01 marks each.	Up to 50%	1 hour	10
Internal End Term Test **Pattern**: Two long answer type questions will be asked; student will attempt one question of 05 marks and there shall be five Compulsory short answer type questions of 01 marks each.	Up to 100%	1 hour	10
Total			**20**
PRACTICAL			
Internal End Term: Practical Performance + viva voce Three practical problem-based questions one from each unit shall be asked, student will attempt any two of 10 marks each.	100% Syllabus 2 Hours		20 Exam 10 viva-voce
Total			**30**

SUBJECT: STATISTICS
Semester-Second
Multidisciplinary Course

Course Title: STATISTICAL TECHNIQUES FOR RESEARCH
Course Code: UMDSTT204

Max. Marks: 75 **Credits: (3+0)**

Syllabus for the Academic Session 2022-23,2023-24 and 2024-25

Course Outcomes:

After completing this Course, the student should have

- Knowledge of Research Problem, sources of research problem.
- Ability to understand the usefulness of data collection, distinguish primary and secondary methods, sources of secondary and primary data,
- Ability to distinguish between census and sampling study, reason for opting the sampling methods sampling and non-sampling error
- Ability to deal with problems-based Karl Pearson's Correlation coefficient & Spearman's Rank Correlation Coefficient

Unit I

Research Plan: meaning of Research, type of research, research problem, sources of research problems, formulation of objectives, research design

Unit-II

Collection of data: meaning and need of data, primary and secondary data, sources of secondary collection, methods of collecting Primary data: observation method, interview method, questionnaire method and schedule method, along with their properties advantages and disadvantages of methods.

Unit-III

Sampling Methods: sampling, objectives of sampling, census and sampling, principle steps of sample survey, methods of sampling- random sampling and non-random sampling, sample size, sampling and non-sampling error.
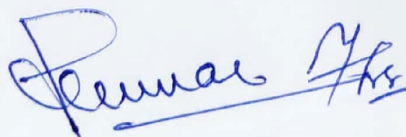
Unit IV

Bi-variate Data: correlation, types of relationships, scatter diagram, Karl-Pearson's correlation coefficient, Spearman rank correlation and its coefficient.
Regression analysis through both types of regression equations for X and Y variables and Y on X, regression coefficient, problems based on regression lines and regression coefficients.

Suggested Readings:

- Goon, A.M., Gupta, M.K. and Dasgupta, B. (1968). Fundamental of Statistics, Vol I, World Press, Kolkata.
- Goon, A.M., Gupta, M.K. and Dasgupta, B. (1968). Fundamental of Statistics, Vol II, World Press, Kolkata.

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Gupta, S.C. and Kapoor, V.K. (2020). Fundamentals of Mathematical Statistics, 12th Edn., Sultan Chand and Sons.

- Kothari, C.R. (2009): Research Methodology: Methods and Techniques, 2nd Revised Edition reprint, New Age International Publishers.
- Kumar, R (2011): Research Methodology: A Step - by - Step Guide for Beginners, SAGE publications.
- Moore, D.S. (2009). The Basic Practice of Statistics. 5th Ed., W H Freeman.
- Neter, J (1987). Applied Statistics. 3rd Ed. Allyn and Bacon.
- Rowntree, D. (2018). Statistics Without Tears: An Introduction For Non-Mathematicians. Penguin Press
- Starnes, D.S (2022). The Practice of Statistics, 8th Ed., W H Freeman.
- Ummer, E.K. (2022). Basic Statistics for Economics, Business and Finance, Atlantic Publication.
- Walpole, R.E and Myers, R.H. (2013). Probability and Statistics for Engineers and Scientist. 9th Ed.,

SCHEME OF EXAMINATION

THEORY	Syllabus to be covered in the examination	Time allotted	% Weightage (Marks)
Mid-term Assessment Test shall be conducted by the course coordinator. **Pattern**: One long answer type question of 10 marks and Five short answer type questions of marks each.	Up to 50%	$1\frac{1}{2}$ hours	15
External End Semester University Exam **Pattern**: As proposed by the concerned BOS and approved by Academic Council	Up to 100%	03 hours	60
Total			75

NOTE FOR PAPER SETTING: End Semester External University Examination

The question paper will contain **TWO** Sections.
Section-A will consist of **FOUR COMPULSORY** short answer type questions (to be answered in 70-80 words) i.e., one question from each unit. Each question shall carry **3 marks.**
Section -B will contain **EIGHT** long answer type questions (to be answered in 500-600 words), Two questions from each unit and the student has to attempt FOUR questions selecting one question from each unit. Each question shall carry 12 marks.

SUBJECT: STATISTICS
Semester-Third
Major/Minor Courses

Course Title: PROBABILITY DIATRIBUTIONS
Course Code: UMJSTT301 (Major) UMISTT303 (Minor)

Max. Marks: 100   **Credits: 3+1**

Syllabus for the Academic Session 2023-24,2024-25 and 2025-26

Course prerequisites: To study this course, a student must have opted/passed the UMJSTT201.

Course Outcomes:

After completing this course, a student will have:
- Ability to understand the concept of W.L.L.N., S.L.L.N. Central Limit Theorem (C.L.T.) and their applications
- Ability to understand the concept of Binomial, Poisson, geometric discrete probability distributions etc.
- Ability to understand continuous probability distribution like normal, uniform and exponential along with their properties
- Ability to deal with Cauchy, gamma and beta of first kind as well as second kind along with their properties

UNIT I

Markov, Jensen & Chebyshev's inequalities, Limit laws: convergence in probability, almost sure convergence, convergence in mean square and convergence in distribution and their inter relations, W.L.L.N., S.L.L.N. and their applications, De-Moivre Laplace theorem, Central Limit Theorem (C.L.T.) for i.i.d. variates, applications of C.L.T. and Liapunov Theorem (without proof).

UNIT-II

Discrete Probability distributions: Bernoulli distribution, binomial distribution, its mean, variance, mode and mgf, recurrence relation for B.D. Definition, moments and mgf. Negative binomial distribution, Poisson distribution and its moments. Poisson distribution as a limiting case of B.D., its mean, variance and mg, Recurrence relation of Poisson distribution, Poisson distribution as a limiting case of negative B.D. recurrence formula for N.B.D. Geometric and Hyper geometric distribution; its definition, mean, variance and relation with Binomial distribution

Unit-III

Rectangular distribution; Moments of rectangular distribution, mgf and mean deviation of rectangular distribution. Normal distribution: its definition, mean, variance and mgf. Properties of Normal curve, simple problems on Normal distribution including area problems, Normal distribution as a limiting case of binomial distribution, under the conditions to be stated. Mean deviation, Median and Mode of Normal distribution.

Unit-IV

Gamma and Beta distribution: Definition and properties of Gamma distribution, beta distribution of first kind as well as of second kind, Cauchy and Exponential distribution along with simple illustrations.

Books Recommended

1. Hogg, R. V., McKean, J. and Craig, A. T. (2012). Introduction to Mathematical Statistics.
2. Kapur, J.N. and Saxena, H.C. (1976). Mathematical Statistics, Sultan Chand and sons.
3. Lindgren, B. (2017). Statistical Theory, 4th Edn., Routledge.

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Mood, A.M. Graybill, F.A. and Boes, D.C. (1974). Introduction to the Theory of Statistics, 3rd Edn., Tata McGraw-Hill Pub. Co. Ltd.

5. Parzen, E. (1960). Modern Probability Theory and its application,

6. Rohatgi, V.K. and Saleh, A.E. (2008). An introduction to Probability Theory and Mathematical Statistics, Wiley Eastern.

Practical Problems:

- Problem based on binomial distributions for n and $p = q = \frac{1}{2}$ given, computing mean and variance
- Application problems based on binomial distribution
- Application problems based on Poisson distribution
- Problems based on area property of normal distribution
- Problems based exponential distribution etc.

SCHEME OF EXAMINATION

THEORY	Syllabus to be covered in the examination	Time allotted	% Weightage (Marks
Mid-term Assessment Test shall be conducted by the course coordinator. **Pattern**: One long answer type question of 10 marks and Five short answer type questions of marks each.	Up to 50%	$1\frac{1}{2}$ hours	15
External End Semester University Exam **Pattern**: As proposed by the concerned BOS and approved by Academic Council	Up to 100%	03 hours	60
			75
Total			
PRACTICAL			
Internal: Daily evaluation of practical records/Viva voce/attendance etc.	10 (including 20% for attendance, 20% for Viva-voce and 40% for internal test and 20% day to day performance)		
External: Final Practical Performance + viva voce	100% Syllabus		15= 10 Exam 05 viva-voce
Total			25

NOTE FOR PAPER SETTING: End Semester External University Examination

The question paper will contain **TWO** Sections.

Section-A will consist of **FOUR COMPULSORY** short answer type questions (to be answered in 70-80 words) i.e., one question from each unit. Each question shall carry **3 marks**.

Section -B will contain **EIGHT** long answer type questions (to be answered in 500-600 words), Two questions from each unit and the student has to attempt FOUR questions selecting one question from each unit. Each question shall carry 12 marks.

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SUBJECT: STATISTICS
Semester-Third
Major Course

Course Title: Statistical Inference
Course Code: UMJSTT302

Max. Marks: 100

Credits: 3+1

Syllabus for the Academic Session 2023-24,2024-25 and 2025-26

Course prerequisites: To study this course, a student must have opted/passed the UMJSTT201.
Course Outcomes:

After completing this course, a student will have:
- Ability to understand the Estimation and criteria for a good estimator,
- Ability to understand the concept of methods of estimation like method of moments and maximum likelihood
- Ability to understand the concept of testing of hypothesis, null and alternative hypotheses, Type-I and Type-II errors, critical region, level of significance.
- Ability to deal with non-parametric tests.

UNIT-I
Estimation: Problem of estimation, theory of estimation, point estimation, interval estimation, criteria for a good estimator, unbiasedness, consistency, efficiency and sufficiency with examples.

UNIT II
Methods of Estimation: Method of moments and maximum likelihood and application of these method for obtaining estimates of parameters of binomial, Poisson and normal distributions, properties of M.L.E's (without proof), merits and demerits of these methods.

UNIT III
Principles of test of significance: Null and alternative hypotheses (simple and composite), Type-I and Type-II errors, critical region, level of significance, size and power, best critical region, most powerful test, uniformly most powerful test, Neyman Pearson Lemma (statement and applications to construct most powerful test). Likelihood ratio test, properties of likelihood ratio tests (without proof).

UNIT IV
Order Statistics: Introduction, distribution of the rth order statistic, smallest and largest order statistics. Joint distribution of rth and s^{th} order statistics, distribution of sample median and sample range.
Non- parametric tests: Concept of Non-parametric tests, advantages of non-parametric tests over parametric tests. Sign test for single sample and two sample problems (for paired and independent samples), Wilcoxon-signed rank test, Mann-Whitney U-test, run test. Median test and test for independence based on Spearman's rank correlation.

SUGGESTED READINGS:

1. Gibbons, J.D. and S. Chakraborti (2020). Non-parametric statistical inference, 6th Edn., by Chapman and Hall/CRC.
2. Kendall and Stuart (1983). The advanced theory of statistics Vol-III.
3. Conover W.J. (1999). Practical Non-parametric Inference 3rd Edn., John Wiley and sons.
4. Hogg., R.V. and Craig A.T. (1972): An Introduction of Mathematical Statistics, Amerind publications.
5. Mood, A.M. Graybill, F.A. and Boes, D.C. (1974). Introduction to the Theory of Statistics, 3rd Edn., Tata McGraw-Hill Pub. Co. Ltd.
6. Srivastava and Srivastava (2009): Statistical Inference: Testing of Hypothesis, Prentice-Hall of India Pvt. Limited.
7. Goon, A.M., Gupta, M.K. and Dasgupta, B. (1991): An Outline of Statistics Volume II, The World Press Pvt Ltd,

Problem based on

- Unbiased estimators, Consistent estimators, efficient estimators and relative efficiency of estimators
- Maximum Likelihood Estimation
- Asymptotic distribution of maximum likelihood estimators
- Testing of hypothesis
- Type I and Type II errors
- Run and Sign test for single sample and two sample problems
- Wilcoxon-signed rank test,
- Mann-Whitney, U-test, run test, Median test etc.

SCHEME OF EXAMINATION

THEORY	Syllabus to be covered in the examination	Time allotted	% Weightage (Marks)
Mid-term Assessment Test shall be conducted by the course coordinator. **Pattern:** One long answer type question of 10 marks and Five short answer type questions of marks each.	Up to 50%	$1\frac{1}{2}$ hours	15
External End Semester University Exam **Pattern:** As proposed by the concerned BOS and approved by Academic Council	Up to 100%	03 hours	60
			75
Total			
PRACTICAL			
Internal: Daily evaluation of practical records/Viva voce/attendance etc.	10 (including 20% for attendance, 20% for Viva-voce and 40% for internal test and 20% day to day performance)		
External: Final Practical Performance + viva voce	100% Syllabus		15 = 10 Exam 05 viva-voce
Total			25

NOTE FOR PAPER SETTING: End Semester External University Examination

The question paper will contain **TWO** Sections.

Section-A will consist of **FOUR COMPULSORY** short answer type questions (to be answered in 70-80 words) i.e., one question from each unit. Each question shall carry **3 marks.**

Section -B will contain **EIGHT** long answer type questions (to be answered in 500-600 words), Two questions from each unit and the student has to attempt FOUR questions selecting one question from each unit. Each question shall carry 12 marks.

SUBJECT: STATISTICS
Semester-Third
Skill Enhancement Course

Course Title: ADVANCE ANALYTICS IN R FOR DATA SCIENCE
Course Code: USESTT304
Max. Marks: 50   **Credits: 0+2**

Syllabus for the Academic Session 2023-24,2024-25 and 2025-26

Course Outcomes:
After completing this course, a student will have: Basic Knowledge of R programming with some basic notions for developing their own simple programs and visualizing graphics in R. Ability to perform data analysis using R.

UNIT-I
Programing in R: functions in R, syntax for R, control statements: while and for statements, nested loops, break and continue etc.
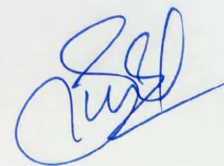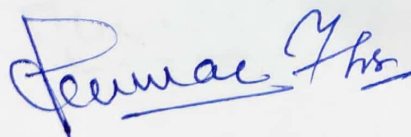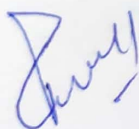
UNIT-II
Random number generation and sampling procedures. Fitting of polynomials and exponential curves. Application Problems based on fitting of suitable distribution like binomial passion, normal etc., Normal probability plot, ggplot.

UNIT-III
Inferential Statistics- Parametric test: Test for Normality, t-test for single mean, t-test for difference between means, paired t-test, Chi-square for goodness of fit, F-test, Analysis of Variance (One- way & Two-way ANOVA), Wilcoxon signed rank test, Mann Whitney U test, Kolmogorov-Smirnov Test for normality,

SUGGESTED READING:

1. Braun W J, Murdoch D J (2007): A First Course in Statistical Programming with R. Cambridge University Press. New York.
2. Gardener, M (2012) Beginning R: The Statistical Programming Language, Wiley Publications.
3. Crawley, M.J. (2017). The R Book, John Wiley & Sons. Eckhouse.
4. Davies, T. M. (2016). The Book of R: A First Course in Programming and Statistics, No Starch Press, San Francisco.
5. Field, A., Miles, J. and Field, Z. (2012). Discovering Statistics using R, Sage, Los Angeles.
6. Kabacoff, R.I. (2015). R in Action: Data Analysis and Graphics in R, 2nd ed., Manning Publications.
7. Matloff, N. (2011). The Art of R Programming, No Starch Press, Inc. Eckhouse,

SCHEME OF EXAMINATION

THEORY	Syllabus to be covered in the examination	Time allotted	% Weightage (Marks)
Internal Mid-Term Test **Pattern**: Two long answer type questions will be asked; student will attempt one question of 05 marks and there shall be five Compulsory short answer type questions of 01 marks each.	Up to 50%	1 hour	10
Internal End Term Test **Pattern**: Two long answer type questions will be asked; student will attempt one question of 05 marks and there shall be five Compulsory short answer type questions of 01 marks each.	Up to 100%	1 hour	10
Total			**20**
PRACTICAL			
Internal End Term: Practical Performance + viva voce Three practical problem-based questions one from each unit shall be asked, student will attempt any two of 10 marks each.	100% Syllabus 2 Hours		30= 20 Exam 10 viva-voce
Total			**30**

SUBJECT: STATISTICS
Semester-Third
Multidisciplinary Course

Course Title: ADVANCED STATISTICS FOR RESEARCHERS
Course Code: UMDSTT305
Max. Marks: 75   **Credits: (3+0)**

Syllabus for the Academic Session 2023-24,2024-25 and 2025-26

Course Outcomes:
- Ability to understand the concept of testing of hypothesis, null and alternative hypotheses, Type-I and Type-II errors, critical region, level of significance.
- Ability to understand Parametric test: t-test for single mean, difference of mean and paired t-test
- Ability to deal with Analysis of Variance and Multivariate analysis technique.
- Ability to deal with non-parametric tests

UNIT I

Principles of test of significance: Null and alternative hypotheses (simple and composite), Type-I and Type-II errors, critical region, level of significance, size and power, best critical region, most powerful test, p-value, confidence interval, one tail and two-tailed test, degree of freedom, test of significance for single proportion, test of significance for difference proportion, z-test.

UNIT II

Inferential Statistics- Parametric test: Test for Normality, t-test for single mean, t-test for difference between means, paired t-test, applications of t-test, chi- square goodness of fit, coefficient of contingency, chi- square as test for comparing variance, applications of chi-square test.
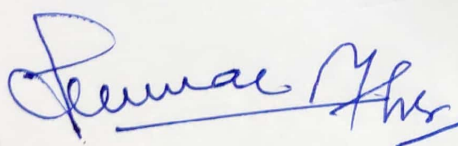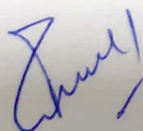
Unit- III

Analysis of Variance and Covariance: F-test, analysis of variance -one- way & two-way ANOVA, analysis of co-variance (ANCOVA), Multivariate analysis technique, factor Analysis, principal-component method of factor analysis.

UNIT IV

Non- Parametric test: sign test, run test, Wilcoxon signed rank sum test, Mann Whitney U test, Kolmogorov-Smirnov Test for normality, spearman rank correlation.

SUGGESTED READING:
1. Conover W.J. (1999). Practical Non-parametric Inference 3rd Edn., John Wiley and sons.
2. Gibbons, J.D. (2020) Non-parametric statistical inference, 6th Edn, Chapman and Hill/CRC.
3. Goon, Gupta and Dass Gupta, (1980) An outline of statistical inference, Vol-II, World Press private, Kolkata.
4. Hogg. and Craig A.T. (2019) Introduction of Mathematical Statistics.
5. Kendall and Stuart, (1946) The advanced theory of statistics Vol-II.
6. Mood, A.M. Graybill, F.A. and Boes, D.C. (1974). Introduction to the Theory of Statistics, 3rd Edn., Tata McGraw-Hill Pub. Co. Ltd.

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7. Saxena, H.C. (1967) Statistical inference, Sultan Chand and Sons.
8. Srivastava and Srivastava (2009): Statistical Inference: Testing of Hypothesis, Prentice-Hall of India Pvt. Limited.

SCHEME OF EXAMINATION

THEORY	Syllabus to be covered in the examination	Time allotted	% Weightage (Marks)
Mid-term Assessment Test shall be conducted by the course coordinator. **Pattern**: One long answer type question of 10 marks and five short answer type questions of marks each.	Up to 50%	$1\frac{1}{2}$ hours	15
External End Semester University Exam **Pattern**: As proposed by the concerned BOS and approved by Academic Council	Up to 100%	03 hours	60
Total			75

NOTE FOR PAPER SETTING: End Semester External University Examination

The question paper will contain **TWO** Sections.

Section-A will consist of **FOUR COMPULSORY** short answer type questions (to be answered in 70-80 words) i.e., one question from each unit. Each question shall carry **3 marks.**

Section -B will contain **EIGHT** long answer type questions (to be answered in 500-600 words), Two questions from each unit and the student has to attempt FOUR questions selecting one question from each unit. Each question shall carry 12 marks.